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IN THE CLAIMS:

1. *(currently amended)* A Fourier domain optical coherence tomography (FDOCT) arrangement for measuring predetermined characteristics of an optically transparent object, the FDOCT arrangement ~~consisting of~~ comprising

- a broadband lightwave source for generating a broadband optical test signal;
- an optical beam splitter including a pair of input arms and a pair of output arms, a first input arm coupled to the output of the broadband lightwave source for supporting the propagation of the broadband optical test signal through the optical beam splitter,
- a lensing arrangement coupled to a first output arm of the optical beam splitter, the lensing arrangement for first collimating and then focusing the broadband optical test signal toward an optically transparent object to be measured; and
- an optical ~~spectrometer~~ Fourier transform device, coupled to a second input arm of the pair of input arms of the optical beam splitter, said optical Fourier transform device ~~spectrometer~~ receptive to a plurality of interfering reflected signals from the optically transparent object disposed beyond the lensing arrangement, the optical Fourier transform device ~~spectrometer~~ for providing a spectrogram signal of the plurality of interfering reflected signals and generating a fast Fourier transform of the spectrogram signal associated with the optical path length of the optically transparent object, wherein signal peaks within the fast Fourier transform are related to transition interfaces between materials in the optically transparent object and are associated with the predetermined characteristics of the optically transparent object.

2. *(previously presented)* The arrangement as defined in claim 1 wherein at least one predetermined characteristics of the optically transparent object is the thickness of a layer within the optically transparent object, the thickness determined by filtering the peaks in the fast Fourier transform, and performing an inverse fast Fourier transform on the filtered signal within the optical Fourier transform device to retrieve a cosine waveform corresponding to the interference between two adjacent layers within the optically transparent object.

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3. – 4. *cancelled*

5. *(original)* The arrangement as defined in claim 1 wherein the lensing arrangement comprises a first collimating lens and a second focusing lens.

6. – 8. *cancelled*

9. *(original)* The arrangement as defined in claim 1 wherein the optical beam splitter is a 50:50 beam splitter.

10. *(original)* The arrangement as defined in claim 8 wherein the broadband lightwave source comprises an erbium-doped fiber lightwave source.

11. *(original)* The arrangement as defined in claim 1 wherein the broadband lightwave source comprises a continuum lightwave source.

12. *cancelled*

13. *(original)* The arrangement as defined in claim 1 wherein the arrangement is utilized with an optical fiber as the optically transparent object.

14. *(currently amended)* A method for determining the thickness of separate layers within a multi-layer optical fiber ~~characteristics of an optical fiber~~ using a Fourier domain optical coherence tomography (FDOCT) technique, the method ~~consisting~~ comprising the steps of:

illuminating the multi-layer optical fiber, in a direction essentially perpendicular to the fiber axis, with a focused broadband light;

collecting reflected signals from a plurality of interfaces between the separate layers within the multi-layer optical fiber at an optical spectrometer, the plurality of interfaces including interfaces between air and an outer fiber surface and interfaces

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between said separate layers within the multi-layer optical fiber, the reflected signals forming an interference pattern of a cosine signal form;

applying a fast Fourier transform to the interference pattern to generate a frequency domain representation associated with the optical path length of the optical fiber, where peaks in the fast Fourier transform are associated with interfaces between different layers within the optical fiber;; and

determining the thickness of said separate layers by measuring the distance between adjacent peaks in the fast Fourier transform. ~~allowing for the thickness of separate layers to be determined.~~

15. *(currently amended)* The method as defined in claim 14, wherein the method further ~~consists~~ comprises the steps of:

filtering the peaks within the generated fast Fourier transform;

applying an inverse fast Fourier transform to the filtered signal to retrieve a cosine waveform corresponding to the interference between any two adjacent surfaces; and

analyzing the cosine waveform to calculate the distance between any two interfaces within the optical fiber and determine the thickness of each separate layer within the multi-layer optical fiber.

16. *(currently amended)* The method as defined in claim 14 wherein, the method ~~consisting~~ comprises the further steps of:

re-orienting the fiber with respect to the illuminating broadband light so as to illuminate the fiber surface at a location 90° from an initial set of measurements to measure characteristics associated with the eccentricity between the optical fiber and an outer coating layer; and

comparing the thickness results from the re-oriented set of measurements with the thickness results from the initial set of measurements, wherein a difference in thickness for the outer coating layer between the two sets of measurements is indicative of the presence of eccentricity between the optical fiber and the outer coating layer; and

generating an output signal associated with the amount of eccentricity present between the optical fiber and the outer coating layer.

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17. *(currently amended)* The method as defined in claim 14 wherein the method further ~~comprises the steps~~ consists of:

applying the reflected signals as an input to a polarization beam splitter;

collecting reflected signals of a first polarization state at a first optical spectrometer;

collecting reflected signals of a second, orthogonal polarization state at a second optical spectrometer;

applying a fast Fourier transform to each of the interference patterns generated by the first and second optical spectrometers; and

comparing the thickness results associated with each fast Fourier transform to measure characteristics of eccentricity between the optical fiber and the outer coating layer, wherein a difference in thickness results for the outer cladding layer between the orthogonal polarization states is indicative of the presence of eccentricity between the optical fiber and the outer coating layer.

18. *(currently amended)* The method as defined in claim 14 wherein the method ~~is used to measure the characteristic of the presence of unwanted sub-surface features, the method comprising the further~~ comprises the step consists of:

recognizing the presence of unwanted peaks in the fast Fourier transform to measure the characteristics of the presence of unwanted sub-surface features, unwanted peaks defined as any peaks not associated with known interfaces between different layers within the fiber structure.

19. *cancelled*

20. *(previously presented)* The method as defined in claim 14 wherein in performing the illuminating step, the illuminated optical fiber comprises a microstructured optical fiber including a plurality of regularly arranged air holes, and in performing the step of applying the fast Fourier transform, measuring the fiber characteristics associated with the size and distribution of the air holes within the fiber.

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21. *(currently amended)* The method as defined in claim 20 wherein the method comprises the further ~~consists step~~ of reviewing the fast Fourier transform peaks, where the difference between successive peak locations is related to the separation between adjacent air holes.

22. *(currently amended)* The method as defined in claim 14 wherein the method comprises the further ~~consists steps~~ of:

determining a draw tension applied to the fiber during a draw process, and for each draw tension;

controlling the polarization of the illuminating signal such that a first set of measurements is associated with a parallel polarization state of the illuminating signal, with respect to the fiber axis, and a second set of measurements is associated with a perpendicular polarization state of the illuminating signal, with respect to the fiber axis;

generating a first spectrogram associated with the parallel polarization illumination and a second spectrogram associated with the perpendicular polarization illumination; and

comparing the difference in spectrograms for the parallel and perpendicular polarizations, the difference associated with the presence of birefringence in the fiber being drawn.

23. *(currently amended)* The method as defined in claim 14 wherein the method further consists ~~comprises the step~~ of placing the fiber in an optical cavity prior to illuminating the fiber so as to increase the number of reflective surfaces and provide additional information in the generated fast Fourier transform associated with the geometric thickness and optical thickness of the optical fiber.